PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Proximity Detector Circuit

We, PYE LIMITED, a British Company of Radio Works, St. Andrews Road, Cambridge, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a proximity detector circuit including a capacitance sensitive device connected to an electronic circuit and causing an alteration in conditions in the circuit and hence the operation of a relay or other device or indicating member when the capacity at the capacitance sensitive device is altered.

According to the present invention a proximity detector comprises a crystal controlled oscillator having a resonant circuit which includes a sensing capacitance, means for causing the resonant frequency of the resonant circuit to be below that of the crystal and such that oscillations occur normally but only when the difference between the two resonant frequencies is less than an amount predetermined by the characteristics of the circuit, the sensing capacitance being adapted to increase that difference and therefore to stop oscillation in the event of an object entering into the proximity of the sensing capacitance and an output circuit adapted to detect the oscillations when present and produce therefrom a current which operates a relay or the like or an indicating device.

In a more specific form the invention provides a proximity detector circuit comprising an oscillating valve having a piezo-electric crystal connected between the grid and cathode of the valve, the anode to grid capacitance of said valve providing feedback, and the oscillator being resistance-capacity coupled to a load circuit comprising a coil and a capacitance sensitive device.

Preferably the oscillator comprises a Pierce-Miller circuit wherein the crystal operates on its fundamental frequency. The coil is preferably provided with an adjustable core and a small trimmer capacitor may be connected across the coil, these adjustments serving to enable the circuit to be set up correctly.

The output from the oscillator may be fed to a detector circuit, such as a leaky grid detector, having a relay connected in its output circuit, the arrangement being such that so long as the circuit is oscillating the relay is operated but when the circuit ceases to oscillate, upon alteration of the capacity existing at the capacitance sensitive device, the relay is de-energised.

The invention will now be further described with reference to the drawing accompanying the Provisional Specification which illustrates a circuit diagram of one embodiment of proximity detector circuit according to this invention.

Referring to the drawing the triode valve V1 is arranged in a Pierce-Miller oscillator circuit and has a piezo-electric crystal X connected between its grid and cathode. The anode-grid capacitance of the valve provides the necessary feedback. The crystal is required to operate on its fundamental frequency. A grid leak resistor R1 is connected across the crystal which in this type of circuit operates at a frequency at which its reactance is positive. The triode oscillator V1 is coupled by means of the anode load resistor R2 and capacitor C1 to the load circuit which comprises a coil L1 having an adjustable core, and a capacitance sensitive device formed by a guard plate G and the connecting cable thereto. A small trimmer capacitor C2 is connected across the coil L1 which, together with the adjustable core, allows the circuit to be set up correctly.

The oscillations are fed through a further capacitor C3 to the control grid of the pentode valve V2 arranged to operate as a leaky grid detector and which has the operating coil L2 of a relay connected in series with its anode. The relay is therefore energised so long as oscillations are present but is de-energised when oscillations cease. With such an arrangement a failure in the circuits ensures safe conditions.

Preferably the circuit is fed from a stabilised power supply to enable it to be set up precisely and to avoid subsequent power fluctuations causing any malfunctioning of the device.

The circuit arrangement above described is extremely sensitive to variations in capacity at the guard plate as it takes full advantage of the characteristics of the oscillator and it has been found that when properly set up, a capacitance change of 0.5 picofarads at the guard plate is sufficient to stop the circuit from oscillating. This desired result can be achieved by tuning the resonant circuit to a frequency below the oscillator frequency at a point where reliable oscillation is just present. The connecting cable and the guard plate may have a capacity in the region of 50 to 60 picofarads and the resonant frequency may be of the order of 3 to 4 Megacycles. Any slight increases in the capacity of the guard plate to earth or other reference potential will then alter the frequency of the resonant circuit sufficiently to stop the oscillations. Valves V1 and V2 may be located in a common envelope.

The actual form of capacitance sensitive device employed depends upon the type of equipment with which the proximity detector circuit is to be used. In one form for use with X-ray apparatus, the guard plate comprises a flat plate insulated from the X-ray machine and lying immediately under the path of the X-rays. When the X-ray machine is operating, a lead shutter is raised under the control of the relay operated by V2 but any increase in capacity at the guard plate due for example to an operator's fingers coming into its proximity causes the shutter to drop and cut off the X-ray beam. For use in conjunction with power presses the capacitance sensitive device may conveniently take the form of a bar or ring and wherein the circuit is employed for detecting the presence of an intruder in a building or prohibited area any other suitable form of capacitance sensitive device may be used.

WHAT WE CLAIM IS:—

1. A proximity detector comprising a crystal controlled oscillator having a resonant circuit which includes a sensing capacitance, means for causing the resonant frequency of the resonant circuit to be below that of the crystal and such that oscillations occur normally but only when the difference between the two resonant frequencies is less than an amount predetermined by the characteristics of the circuit, the sensing capacitance being adapted to increase that difference and therefore to stop oscillation in the event of an object entering into the proximity of the sensing capacitance and an output circuit adapted to detect the oscillations when present and produce therefrom a current which operates a relay or the like or an indicating device.

2. A proximity detector according to claim 1, in which the oscillator circuit comprises a Pierce-Miller circuit.

3. A proximity detector according to claims 1 or 2, in which the oscillator circuit comprises an oscillator valve having a piezo-electric crystal connected between the grid and cathode of said valve, the anode to grid capacitance of said valve providing feedback, and the oscillator being resistance capacity coupled to said resonant circuit.

4. A proximity detector according to any preceding claim, in which said output circuit comprises a valve arranged as a leaky grid detector having its anode connected to a high potential source via a relay.

5. A proximity detector according to claim 3 in which said resonant circuit includes means for adjusting its resonant frequency.

6. A proximity detector according to any preceding claim in which said oscillator and said output circuit are connected to a stabilised power supply.

7. A proximity detector according to any preceding claim in which said relay operates to raise a lead shutter lying in the path of an X-ray beam, said beam being directed adjacent to a guard plate comprising part of said sensing capacitance.

8. A proximity detector substantially as hereinbefore described with reference to the drawings accompanying the Provisional Specification.

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942897 PROVISIONAL SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*